

How many more Hoosiers need to be vaccinated to significantly decrease the burden of a 3rd wave of 2009 H1N1 illness?

Indiana State Department of Health, Surveillance and Investigation Division Estimates – January 15, 2010

- The *basic reproduction number* (R_0) of an infection is the average number of additional cases a single infected case will cause in a population with no immunity and without other interventions to control the infection.
- While it does have limitations, it helps determine whether or not an infectious disease will spread through a population.
- Generally, the larger the R_0 , the harder it is to control the epidemic.
- The percentage of the population that needs to be vaccinated and/or become ill to provide “herd immunity”¹ and prevent spread of the infection is given by $1 - 1/R_0$.

Estimated basic reproductive number for various infectious diseases and their impact on “herd immunity” in Indiana residents

Disease	Estimated R_0 (basic reproduction number)	Percent of Hoosiers that need to be vaccinated and/or become ill to offer “herd immunity”	Estimated # of Hoosiers that need to be vaccinated and/or become ill to prevent further spread
Measles	15	93.3%	5,994,905
Mumps	5.5	81.8%	5,255,274
Spanish flu (1918/19)	2.5	60.0%	3,853,868
Asian flu (1957/58)	1.8	44.4%	2,854,717
2009 H1N1	1.7	41.2%	2,644,811

Herd immunity calculations based on the estimated basic reproductive number for 2009 H1N1 – Indiana, Apr 2009–Jan 12, 2010

Estimated # of Hoosiers ill with 2009 H1N1 (% population) ²	Estimated # of Hoosiers who had asymptomatic 2009 H1N1 infections ³	Total # of Hoosiers who received the 2009 H1N1 vaccine ⁴	Estimated # of Hoosiers immune to 2009 H1N1 ⁵	Corrected # of Hoosiers immune to 2009 H1N1 due to group overlap ⁶	Estimated # of Hoosiers that need to be vaccinated and/or become ill to prevent further spread	Total # of Hoosiers that still need to be vaccinated (or become ill) to have “herd immunity”
1,153,347	346,004	995,715	2,495,066	2,245,559	2,644,811	399,252

KEY POINT: *In order for Indiana to significantly decrease the burden of a 3rd wave of 2009 H1N1 illness, more than 400,000 additional Hoosiers need to be vaccinated as soon as possible. At the current rate of illness and vaccine administration, it will take us at least 6 weeks to hit this milestone.*

¹ Herd immunity = Immunity of a sufficient number of individuals in a population such that infection of one individual will not result in an epidemic

² Methodology explaining this estimation can be found at: http://www.cdc.gov/h1n1flu/estimates_2009_h1n1.htm (Indiana ≈2% of the U.S. population)

³ 30% used as an estimate for the number of people infected but have no clinical illness. Carrat F, Vergu E, Ferguson NM, Lemaitre M, Cauchemez S, Leach S, Valleron AJ. Time lines of infection and disease in human influenza: a review of volunteer challenge studies. *Am J Epidemiol.* 2008 Apr 1;167(7):775-85

⁴ Based on 2009 H1N1 vaccinations administered and recorded in the Children and Hoosiers Immunization Registry Program (CHIRP) database

⁵ Estimated # of Hoosiers immune = Estimated # of Hoosiers ill + Estimated # of asymptomatic Hoosiers + Total # of Hoosiers vaccinated

⁶ Decreased the “Estimated # of Hoosiers immune to 2009 H1N1” by 10% to correct for overlap in the three groups that comprise that total